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POTENTIAL USE OF THERMOELECTRIC GENERATORS FOR THE EQUIPMENT ON THE MOON

Abstract

The development of advanced lunar power subsystems with a high stability and durability is the first step to successfully complete the long-term resident missions of the moon because of its severe environmental conditions. Currently most power subsystems are based around the harvesting and storage of solar energy, a field of technology which is well known and has a proven track record. However, at the lunar night which lasts about 14 earth days, the temperature on the moon's surface is about 90 K, which is too difficult for a chemical battery supporting its equipment. Nuclear energy is an effective solution for this kind of mission, but the radioisotopes are subject to strict regulations in addition to being a rare and expensive resource. In this work, a thermoelectric generator without any radioisotopes was especially designed for the lunar environment. From the experiment data tested by Apollo 15 and Apollo 17, it is found that the temperature is mainly controlled by the internal heat flow of the moon and stabled around 250 K at the depth over 0.8 meter below the moon's surface. The thermoelectric module, operating on the Seebeck Effect, utilized the considerable temperature difference between the moon's surface and 1-meter-deep underground. As there is no mechanism in this generator, it could have a high stability and reliability, and is expected to be an important potential power subsystem in the equipment such as lunar surface beacon and communication.